CAREER GUIDE FOR ELECTRICAL ENGINEERS

SOC Code: 17-2071

Pay Bands: 5 (Salary Structure)

Standard Occupational Description: Design, develop, test, or supervise the manufacturing and installation of electrical equipment, components, or systems for commercial, industrial, military, or scientific use.

Electrical Engineer positions in the Commonwealth are assigned to the following Roles in the Architecture and Engineering Career Group:

Architect/ Engineer I

Architecture/ Engineering Manager I

While Electrical Engineers within the Commonwealth are all located within the Architecture and Engineering Career Group, individuals may want to pursue other managerial opportunities within the Commonwealth depending upon individual training, education, knowledge, skills, abilities, and interests.

Other Career Group(s) that may be of interest are:
General Administration

Program Administration

SKILLS, KNOWLEDGE, ABILITIES AND TASKS

(Technical and Functional Expertise)

Skills

Note: *The technical and functional skills listed below are based on general occupational qualifications for Electrical Engineers commonly recognized by most employers. Typically, you will not be required to have all of the skills listed to be a successful performer. Recruitment and selection standards for an individual state job must be based on the specific knowledge, skills, and abilities for that job as indicated in the job announcement and job description in the Employee Work Profile.*

Skills

1. Using mathematics and scientific rules and methods to solve problems.
2. Understanding written sentences and paragraphs in work related documents.
3. Considering the relative costs and benefits of potential actions to choose the most appropriate one.
4. Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
5. Generating or adapting equipment and technology to serve user needs.
6. Communicating effectively in writing as appropriate for the needs of the audience.
7. Understanding the implications of new information for both current and future problem-solving and decision-making.
8. Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.

9. Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
10. Talking to others to convey information effectively.
11. Analyzing needs and product requirements to create a design.
12. Determining the kind of tools and equipment needed to do a job.
13. Watching gauges, dials, or other indicators to make sure a machine is working properly.
14. Determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes.
15. Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things.
16. Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.
17. Writing computer programs for various purposes.
18. Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
19. Identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system.
20. Determining causes of operating errors and deciding what to do about it.

Knowledge

Note: *The technical and functional knowledge statements listed below are based on general occupational qualifications for Electrical Engineers commonly recognized by most employers. Typically, you will not be required to have all of the knowledge listed to be a successful performer. Recruitment and selection standards for an individual state job must be based on the specific knowledge, skills, and abilities for that job as indicated in the job announcement and job description in the Employee Work Profile.*

The **Knowledge** of:

1. The practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
2. Circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
3. Arithmetic, algebra, geometry, calculus, statistics, and their applications.
4. Design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
5. Raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
6. Materials, methods, and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads.
7. Business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.
8. The prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub- atomic structures and processes.
9. The structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
10. Relevant equipment, policies, procedures, and strategies to promote effective local, state, or national security operations for the protection of people, data, property, and institutions.
11. Machines and tools, including their designs, uses, repair, and maintenance.
12. Transmission, broadcasting, switching, control, and operation of telecommunications systems.

Abilities

Note: *The technical and functional abilities listed below are based on general occupational qualifications for Electrical Engineers commonly recognized by most employers. Typically, you will not be required to have all of the abilities listed to be a successful performer. Recruitment and selection standards for an individual state job must be based on the specific knowledge, skills, and abilities for that job as indicated in the job announcement and job description in the Employee Work Profile.*

The **Ability** to:

1. Read and understand information and ideas presented in writing.
2. Communicate information and ideas in writing and in speaking so others will understand.
3. Listen to and understand information and ideas presented through spoken words and sentences.
4. Choose the right mathematical methods or formulas to solve a problem.
5. Apply general rules to specific problems to produce answers that make sense.
6. Arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
7. Come up with a number of ideas about a topic (the number of ideas is important, not their quality, correctness, or creativity).
8. Imagine how something will look after it is moved around or when its parts are moved or rearranged.
9. Tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
10. See details at close range (within a few feet of the observer).
11. Come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.
12. Combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
13. Quickly make sense of, combine, and organize information into meaningful patterns.
14. Generate or use different sets of rules for combining or grouping things in different ways.
15. Quickly and accurately compare similarities and differences among sets of letters, numbers, objects, pictures, or patterns. The things to be compared may be presented at the same time or one after the other. This ability also includes comparing a presented object with a remembered object.
16. Speak clearly so others can understand you.
17. Make fast, simple, repeated movements of the fingers, hands, and wrists.
18. Remember information such as words, numbers, pictures, and procedures.

Tasks

1. Designs electrical instruments, equipment, facilities, components, products, and systems for commercial, industrial, and domestic purposes.
2. Plans and implements research methodology and procedures to apply principles of electrical theory to engineering projects.
3. Prepares and studies technical drawings, specifications of electrical systems, and topographical maps to ensure installation and operations conform to standards and customer requirements.
4. Develops applications of controls, instruments, and systems for new commercial, domestic, and industrial uses.
5. Directs operations and coordinates manufacturing, construction, installation, maintenance, and testing activities to ensure compliance with specifications, codes, and customer requirements.

6. Plans layout of electric power generating plants and distribution lines and stations.
7. Conducts field surveys and studies maps, graphs, diagrams, and other data to identify and correct power system problems.
8. Performs detailed calculations to compute and establish manufacturing, construction, and installation standards and specifications.
9. Confers with engineers, customers, and others to discuss existing or potential engineering projects and products.
10. Inspects completed installations and observes operations for conformance to design and equipment specifications, and operational and safety standards.
11. Evaluates and analyzes data regarding electric power systems and stations, and recommends changes to improve operating efficiency.
12. Estimates labor, material, and construction costs, and prepares specifications for purchase of materials and equipment.
13. Collects data relating to commercial and residential development, population, and power system interconnection to determine operating efficiency of electrical systems.
14. Compiles data and writes reports regarding existing and potential engineering studies and projects.
15. Operates computer-assisted engineering and design software and equipment to perform engineering tasks.
16. Investigates customer or public complaints, determines nature and extent of problem, and recommends remedial measures.

INTERESTED?

Like people, occupations have traits or characteristics. These characteristics give important clues about the nature of the work and work environment, and give you an opportunity to match your own personal interests to a specific occupation. When you choose a job in an occupation that matches your own interests you have taken an important step in planning a successful and rewarding career.

Electrical Engineering work is called mainly a “Realistic Occupation” because it involves work activities that include practical, hands-on problems and solutions. They often deal with plants, animals, and real-world materials like wood, tools, and machinery. Many of the occupations require working outside, and do not involve a lot of paperwork or working closely with others. It can also be “Investigative” since it may frequently involve working with ideas, require an extensive amount of thinking, and can involve searching for facts and figuring out problems mentally.

LICENSURE, REGISTRATION, OR CERTIFICATION REQUIREMENTS

Generally this is not required for Electrical Engineer positions in state government. However, to improve career advancement opportunities, you should consider the advantages of certification and include this step in your self-development plan. The Professional Engineer license may be required for some Electrical Engineer positions. These positions are identified by each state agency.

Licensing information can be found on the Department of Professional & Occupational Regulations’ web site at http://www.dpor.state.va.us

EDUCATIONAL, TRAINING, AND LEARNING OPPORTUNITIES

Professional occupations like Electrical Engineering usually require a college degree and may require some job-specific training.

Sources of educational, training, and learning opportunities include:

1. Graduate from an engineering curriculum accredited by the Accreditation Board for Engineering and Technology.
2. Join professional organizations.
3. Specific data regarding an engineering discipline follows:

ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEER: An instructional program that prepares individuals to apply mathematical and scientific principles to the design, development and operational evaluation of electrical, electronic and related communications systems and their components, including electrical power generation systems; and the analysis of problems such as super-conduction, wave propagation, energy storage and retrieval, and reception and amplification.

COMMONWEALTH COMPETENCIES

Competencies are a set of identified behaviors, knowledge, skills, and abilities that directly and positively impact the success of employees and the organization. Competencies can be observed and measured. When consistently demonstrated, competencies make employees particularly effective in their work. Competencies help lay out a road map to career success. You can use the Commonwealth Competencies to help improve your individual performance by adopting behaviors that make high performing employees successful in their jobs. In this way, you can use the Commonwealth Competencies for your further professional development.

The Commonwealth Competencies are:

1. Technical and Functional Expertise
2. Understanding the Business
3. Achieving Results
4. Serving the Customer
5. Teamwork
6. Interpersonal and Communication Skills
7. Leadership and Personal Effectiveness

The above competencies may be applied to employees throughout the Commonwealth of Virginia. They can be rank-ordered by agencies and hiring managers to represent the needs of a specific job. The rank ordering will change depending upon the occupation, an organization's priorities, the actual job requirements, and the supervisor's preferences.

Career success is both about what you do (applying your technical knowledge, skills, and ability) and how you do it (the consistent behaviors you demonstrate and choose to use) while interacting and communicating with others. Hopefully, by studying the Commonwealth competencies, identifying your developmental opportunities, and working to refine your own competence, you can take charge of your career!

For additional information about the **Commonwealth Competencies** go to: http://jobs.state.va.us/cc_planningctr.htm. For the competencies, we first list the competencies and then define each. Finally, we list competency indicators; to describe what successful performance looks like.

COMMONWEALTH CAREER PATH

Career opportunities in the Commonwealth are not limited to moving "up" to the next highest role and pay band, changing positions, or to becoming a supervisor. That's because most roles describe a broad group of occupationally related positions that perform a range of work that requires increased knowledge and skills. For that reason, Commonwealth roles describe the career paths within the same or higher-level role for the same or different Career Group. The broad salary range and the Commonwealth's pay practices provide flexibility in recognizing career development and advancement. (Salary Structure)

For example:

Pay Band	Practitioner Role
5	Architect/Engineer I
	⬇
6	Architect/Engineer II

Pay Band	Manager Role
5	Architect/Engineer Manager I
	⬇
6	Architect/Engineer Manager II
	⬇
7	Architect/Engineer Manager III
	⬇
8	Architect/Engineer Manager IV

Sample Career Path

Architect/Engineer I
The Architect/Engineer I role provides career tracks for architects or engineers whose expertise levels range from trainee to advanced level. Responsibilities include applying architecture/engineering principles and practices to projects of varying complexity in specialty areas. Specialty areas include those requiring knowledge of civil, environmental, structural, mechanical, electrical, transportation, traffic, safety, materials, or rehabilitation engineering and architecture.

Architect/Engineer II
The Architect/Engineer II role provides career tracks for architects or engineers who serve as an expert or first line supervisor. Duties include evaluating the plans and specifications for capital outlay projects prepared by other architects and engineers; or for applying related engineering principles and practices to complex, extensive and diversified engineering projects in specialty areas.

Architecture/Engineering Manager I

The Architecture/Engineering Manager I role provides career tracks for managers who manage various administrative, budgetary, planning, scheduling and technical activities related to multiple complex architectural/engineering projects or programs and the staff performing related functions. These functions draw upon knowledge of specialty engineering; capital outlay or other

construction projects, transportation, water and wastewater projects or programs and health and safety related operations.

Architecture/Engineering Manager II

The Architecture/Engineering Manager II role provides career tracks for managers who manage, coordinate, and direct the activities of one or more specialized transportation or environmental engineering or health and safety related program operations in their assigned geographic or divisional area. This role also provides career tracks for managers who manage staff and resources related to the procurement, design, construction or renovation of capital projects or non-capital outlay for an entire agency's construction and maintenance reserve programs. This includes budgetary, planning, scheduling, public relations, human resource functions, and technical activities related to a broad range of engineering, administrative and other projects or programs.

Architecture/Engineering Manager III

The Architecture/Engineering Manager III role provides career tracks for managers who direct the transportation engineering, construction, maintenance, administrative and other operations and programs of a defined geographic transportation district. This role provides career tracks for managers who serve as an assistant to the Commissioner for Transportation and direct the operations of divisions and/or districts in areas such as administration, planning and operations. In addition, this role provides career tracks for executive level of Engineering and Buildings, and Facilities Management managers for the Commonwealth and for managers of an agency's design and construction projects that involve multiple facilities with special requirements, such as security provisions and long-term development and evaluation of programs.

Architecture/Engineering Manager IV

The Architecture/Engineering Manager IV role provides a career track for the executive manager who serves as the agency's chief engineer responsible for planning and directing large-scale, multi-division preliminary engineering and construction programs for transportation operations with statewide scope. Directs areas such as location and design, structure and bridge, right of way and utilities, materials and transportation construction. Interfaces with state and federal officials and executives on agency issues and with the Commonwealth Transportation Board.

ADDITIONAL OCCUPATIONAL INFORMATION CAN BE FOUND AT:

O*NET (Occupational Information Network)

http://online.onetcenter.org/gen_search_page

Virginia Employment Commission
http://www.alex.vec.state.va.us/

Department of Professional & Occupation Regulation
http://www.state.va.us/dpor/conNEW_reg.pdf

Career One Stop
http://www.careeronestop.org/

Virginia Career Resource Network
http://www.vacrn.net/